

the sidelobe levels of communication antennas. This recommendation specifies an envelope for the peak sidelobe gains. For a single source on the Earth and a slowly tracking RA antenna the entry path sidelobe gain can remain constant for long periods of time. Hence, the use of the peak sidelobe gain of 0 dBi can be justified. The recommendation also include a suggestion that the RA service seek better antennas with greater sidelobe rejection and that the other radio services seek ways to reduce interference. Hence, the interference reduction activity becomes a joint understanding with equal responsibilities to each service. Current antenna sidelobe gain standards recommend a sidelobe gain level of -10 dBi. Many current telecommunications antennas meet this standard. For moving objects passing through the sidelobes the average antenna gain should be used in place of the peak gain. The peak to average ratio should be in the range of 3 to 5 dB depending on the antenna. A reasonable estimate of the average sidelobe gain (beyond 30° off-boresight, at least) of a typical, reasonably modern Radio Astronomy antenna is about -10 dBi. Future antennas should be able to perform about 5 dB better than this (resulting in a -15 dBi average sidelobe gain). Even during the rare conditions when the galactic noise is very low (the 10 K assumed in report 224) this would limit the desired interference level to about -227 dBW/m²/Hz.

2.3 *Sharing Mechanisms*

The communications services can also share the use of closely spaced (or overlapped) frequency bands with the Radio Astronomy Service by using time diversity. This can be used in two forms with the proposed TDMA/FDMA system. The first technique is to use TDMA duty cycle sharing. By synchronizing the TDMA downlink signal with an international time standard the RA observations can be blanked to reduce the impact of harmful interference. The signal from the proposed TDMA/FDMA system downlink can be blanked with an approximate fifty percent duty cycle during periods of peak activity. This will allow RA observations to take place even when the downlink out-of-band emissions exceed desired levels.

The second type of time sharing is based on time-of-day sharing. When the telecommunications traffic load in the vicinity of an RA site is low the interference to the RA site will be minimal and high sensitivity observations can be made without interference. When telecommunications traffic is high the RA site can make observations in other unaffected bands or can make lower sensitivity observations in the interfered with band. The sensitive observations can be made with predictably low interference during the late night and early morning hours. The telecommunications system can also limit the allowed traffic in an area to control the out-of-band emission strength. Although this would generally be unacceptable during peak traffic hours, this may be acceptable, if needed, during late night and early morning hours.

If the observing time available to the RA community exceeds the needed observing time (as a fraction of the available time for a given RA observatory) then the science of RA has been preserved. The hydrogen spectral lines are the most often observed lines. They are observed up to 25% of the time that an observatory is operating (for the observatories capable of observing these lines). The OH (hydroxyl) spectral lines, including the line at 1612.24 MHz, are considered the second most important lines for study by many Radio Astronomers. We can estimate that they are

observed between 10 and 15 percent of the time. The observations are scheduled by central coordinating committees between 3 and 6 months in advance. As long as all of the needed observations can be made over some reasonable period of time then the true science of Radio Astronomy has been served over that period of time. This need for observing time in the 1610.6 to 1613.8 MHz band can be met with less than 1/3 of the night time hours being available for use.

3. Rational Adjustments to the Proposed Coordination Criterion

The proposed emission limit is based on a percent degradation of the Radio Astronomy service for a constant interfering radio frequency source located on the ground. It has been proposed to extend the CCIR Report 224 limit to a situation that does not match the assumptions made in developing the limit. As such, it unfairly constrains the MSS telecommunications service. At most, the proposed rule should require coordination to avoid harmful interference to RAS sites without including a specific threshold level. The applicant should be required to show how the Radio Astronomy Service can still meet the typical observing desires based on reasonable assumptions. It would be desirable for the representatives of the RA community and the MSS applicant to arrive at a joint understanding about how the nearby frequencies can be used to the best overall benefit. The practicability of limiting out-of-band emissions must also be considered. If the RA observing time needs can be met with practicable alterations to the MSS system then it would be fair to allow the system to operate. Requiring adherence beyond what is practicable can prevent a valuable, life saving telecommunications service from being deployed as well as causing significant negative economic impacts.

4. Discussion

The designers of the proposed TDMA/FDMA system have already altered the system design, with significant cost impact, to protect the Radio Astronomy Service. The channel assignment methods have been altered to assign traffic channels to the upper end of the 1616 to 1626.5 MHz downlink band. This will naturally decrease interference to the RAS band.

The peak out-of-band emissions are not expected to interfere with VLBA observations at any time. The VLBA observations represent the greatest source of information for radio objects of extremely narrow angular extent, to the RA community. The VLBA instrument can resolve two dimensional radio pictures of the sky to greater resolution than any other RA instrument. When the Arecibo site is included in the array the sensitivity of the array is also very significant. Although continuing review is needed, current expectations are that the MSS emissions will also cause negligible interference to the operation of the VLA and to interferometry measurements in general. The Arecibo site is arguably the most sensitive RA site in the world. This site is located in Puerto Rico and happens to be in an area that will have fairly low MSS traffic. Initial results indicate that this site will rarely (if ever) receive any interference above the very low threshold level that has been suggested. These instruments represent the most significant currently-operating instruments available for Radio Astronomy observations to the US RA community. The remaining issue is that of protecting observatories operating by themselves to observe astronomical

phenomena. The new Green Bank telescope, now under construction, is the prime example. Its relatively close geographic proximity to metropolitan Washington DC results in a commensurate challenge to coordination; current indications are that such coordination can be accomplished by technical and operational means combined, without substantial reduction in Green Bank's usability at 1612 MHz.

To protect these other instruments the modulation system of the proposed TDMA/FDMA downlink has been redesigned to limit the spurious emissions in the 1610.6 to 1613.8 MHz radio astronomy band. The L-band amplifier designs have been studied and redesigned with strict out-of-band spurious emissions requirements. The applicant anticipates that the strength of spectral lines due to spurious emissions will be below the desired limits. The out-of-band emissions of concern are formed by intermodulation products of the several modulated FDMA carriers. This interference is the result of the overlap of numerous convolved spectra. When the system is near peak capacity this effect appears to produce an almost flat spectrum across the Radio Astronomy Band. Since spectral lines do not appear, the resulting degradation in RA performance is a loss in sensitivity of the RA receiver.

The applicant is continuing to study the impact of the interference to the RA service. Extensive traffic model simulations combined with an explicit simulation of the transmitter antenna arrays are being used to characterize the amount of the day that the out-of-band emissions exceed levels corresponding to 10% degradation of the RA receiver sensitivity. The current results indicate that the limits are not exceeded during low traffic hours late at night at any site. This corresponds to the time that the RA receivers have the greatest sensitivity. The impact on most sites is small. A blanking device may be needed to meet the observation needs at the Green Bank site. In general, the initial results indicate that there is enough time for the needed RA observations to be made at the sites (primarily Green Bank, Arecibo and--for VLBA work--Socorro) whose equipment is best-suited for spectral line observation at 1612 MHz.

5. Conclusions

The proposed protection criterion for the Radio Astronomy Service (RAS) in the 1610.6 to 1613.8 MHz band should be modified and clarified to take into account more general interference mechanisms. The final criteria for acceptability of interference should be based on the ability of the Radio Astronomy Service to make the desired observations and the requirements of the proposed MSS system.

The interference from the proposed MSS system to the Radio Astronomy service is expected to be acceptable for most observations. VLBA and VLA observations are expected to receive no harmful interference. At virtually all the other sites the interference is believed to be acceptable. Blanking may be required at the Green Bank site during peak traffic hours to provide a large amount of observing time in the 1610.6 to 1613.8 MHz Radio Astronomy band. It is expected that the desired Radio Astronomy observations can be made with coordination and cooperation of the MSS provider and the Radio Astronomy community.

ENGINEERING CERTIFICATE

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in these Comments and the Technical Appendix hereto, that I am familiar with Part 25 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in these Comments and Technical Appendix, and that it is complete and accurate to the best of my knowledge and belief.



Title:

Director of Spectrum

Motorola Satellite Communications

Date:

5/4/94

CHANGES RECOMMENDED BY
MOTOROLA SATELLITE COMMUNICATIONS, INC.
TO THE COMMISSION'S PROPOSED RULES APPENDIX A

Title 47 of the Code of Federal Regulations, Parts 2, 25 and 94, are amended as follows:

1. The Table of Contents for Part 25 is revised to read as follows:

PART 25 - SATELLITE COMMUNICATIONS
Subpart A - General

Sec.

- 25.101 Basis and scope.
- 25.102 Station authorization required.
- 25.103 Definitions.
- 25.104 Preemption of local zoning of earth stations.
- 25.105 - 25.108 [Reserved]
- 25.109 Cross-reference.

Subpart B - Applications and Licenses

- 25.110 Filing of applications, fees, and number of copies.
- 25.111 Additional information.
- 25.112 Defective applications.
- 25.113 Construction permits.
- 25.114 Applications for space station authorizations.
- 25.115 Applications for earth station authorizations.
- 25.116 Amendments to applications.
- 25.117 Modification of station license.
- 25.118 Assignment or transfer of control of station authorization.
- 25.119 Application for special temporary authorization.
- 25.120 License term and renewals.

EARTH STATIONS

- 25.130 Filing requirements for transmitting earth stations.
- 25.132 Verification of earth station antenna performance standards.
- 25.133 Period of construction; certification of commencement of operation.
- 25.134 Licensing provisions of very small aperture terminal (VSAT) networks.
- 25.135 Licensing provisions for earth station networks in the non-voice, non-geostationary mobile-satellite service.
- 25.136 Operating provisions for earth station networks in the 1.6/2.4 GHz mobile-satellite service.

SPACE STATIONS

- 25.140 Qualifications of domestic fixed-satellite space station licensees.
- 25.141 Licensing provisions for the radiodetermination satellite service.
- 25.142 Licensing provisions for the non-voice, non-geostationary mobile-satellite service.
- 25.143 Licensing provisions for the 1.6/2.4 GHz mobile satellite service.

PROCESSING OF APPLICATIONS

- 25.150 Receipt of Applications.
- 25.151 Public notice period.
- 25.152 Dismissal and return of applications.
- 25.153 Repetitious applications.
- 25.154 Opposition to applications and other pleadings.
- 25.155 Mutually exclusive applications.
- 25.156 Consideration of applications.

**FORFEITURE, TERMINATION, AND REINSTATEMENT
OF STATION AUTHORIZATION**

- 25.160 Administrative sanctions.
- 25.161 Automatic termination of station authorization.
- 25.162 Cause for termination of interference protection.
- 25.163 Reinstatement.

Subpart C - Technical Standards

- 25.201 Definitions.
- 25.202 Frequencies, frequency tolerance and emission limitations.
- 25.203 Choice of sites and frequencies.
- 25.204 Power limits.
- 25.205 Minimum angle of antenna elevation.
- 25.206 Station identification.
- 25.207 Cessation of emissions.
- 25.208 Power flux density limits.
- 25.209 Antenna performance standards.
- 25.210 Technical requirements for space stations in the Fixed-Satellite Service.
- 25.211 Video transmissions in the Domestic Fixed-Satellite Service.
- 25.212 Narrowband transmissions in the Fixed-Satellite Service.
- 25.213 Inter-Service coordination requirements for the 1.6/2.4 GHz Mobile-Satellite Service.
- 25.251 Special requirements for coordination.
- 25.252 Maximum permissible interference power.
- 25.253 Determination of coordination distance for near great circle propagation mechanisms.
- 25.254 Computation of coordination distance contours for propagation modes associated with precipitation scatter.

25.255 Guidelines for performing interference analyses for near great circle propagation mechanisms.

25.256 Guidelines for performing interference analyses for precipitation scatter modes. [Reserved]

Subpart D - Technical Operations

25.271 Control of transmitting stations.

25.272 General inter-system coordination procedures.

25.273 Duties regarding space communications transmissions.

25.274 Procedures to be followed in the event of interference.

25.275 Particulars of operation.

25.276 Points of communication.

25.277 Temporary fixed earth station operations.

25.278 Additional coordination obligation for non-geostationary and geostationary satellite systems in frequencies allocated to the Fixed-Satellite Service.

Subpart E - Developmental Operations

25.279 Inter-Satellite Service.

25.300 Developmental operation.

25.308 Automatic Transmitter Identification System (ATIS)

Subparts F - G -- [Reserved]

Subpart H - Authorization To Own Stock in the Communications Satellite Corporation

25.501 Scope of this subpart.

25.502 Definitions.

25.503 - 25.504 [Reserved]

25.505 Persons requiring authorization.

25.506 - 25-514 [Reserved]

25.515 Method of securing authorization.

25.516 - 25.519 [Reserved]

25.520 Contents of application.

- 25.521 Who may sign applications.
- 25.522 Full disclosures.
- 25.523 Form of application, number of copies, fees, etc.
- 25.524 [Reserved]
- 25.525 Action upon applications.
- 25.526 Amendments.
- 25.527 Defective applications.
- 25.528 - 25.529 [Reserved]
- 25.530 Scope of authorization.
- 25.531 Revocation of authorization.

2. The authority citation for Part 25 continues to read as follows:

AUTHORITY: Sections 101 - 404, 76 Stat. 419 - 427; 47 U.S.C. 701 - 744, Sec. 4, 48 Stat. 1066, as amended; 47 U.S.C. 154. Interprets or applies sec. 303, 48 Stat. 1082, as amended; 47 U.S.C. 303.

3. Section 25.114 is amended by revising paragraphs (c)(6), (c)(18), and (c)(26), and adding new paragraphs (c)(28) and (d), to read as follows:

§ 25.114 Applications for space station authorizations.

* * * * *

(c) * * *

(6) (i) For geostationary satellite orbit satellites, orbital location, or locations if alternatives are proposed, requested for the satellite, the factors which support such an orbital assignment, the range of orbital locations from which adequate service can be provided and the basis for determining that range of orbital locations, and a detailed explanation of all factors that would limit the orbital arc over which the satellite could adequately serve its expected users.

(ii) For non-geostationary satellite orbit satellites, the number of space stations and applicable information relating to the number of orbital planes, the inclination of the orbital plane(s), the orbital period, the apogee, the perigee, the argument(s) of perigee, active

service arc(s), and right ascension of the ascending node(s).

* * * * *

(18) Detailed information demonstrating the financial qualifications of the applicant to construct and launch the proposed satellites. Applications for domestic fixed-satellite systems and mobile-satellite systems shall provide the financial information required by § 25.140(b)-(e), § 25.142(a)(4), or § 25.143(b)(3), as appropriate. Applications for international satellite systems authorized pursuant to Establishing of Satellite Systems Providing International Communications, 50 FR 42266 (October 18, 1985), 101 FCC 2d 1046 (1985), recon. 61 RR 2d 649 (1986), further recon. 1 FCC Rcd 439 (1986), shall provide the information required by that decision.

* * * * *

(26) Applications for authorizations in the ~~mobile-satellite~~ Mobile-Satellite Service in the 1545-1559/1646.5-1660.5 MHz frequency bands shall also provide all information necessary to comply with the policies and procedures set forth in Rules and Policies Pertaining to the Use of Radio Frequencies in a Land Mobile Satellite Service, 52 FR 4017 (Feb. 9, 1987), 2 FCC Rcd 485 (1987).

* * * * *

(28) Applications for authorizations in the 1.6/2.4 GHz Mobile-Satellite Service shall also provide all information specified in § 25.143.

(d) Applicants requesting authority to construct and/or launch a system comprised of ~~technically identical~~ functionally equivalent, non-geostationary satellite orbit mobile-satellite service space stations may file a single "blanket" application containing the information specified in paragraph (c) of this section for each representative space station.

4. Section 25.115 is amended by revising paragraph (d) to read as follows:

§ 25.115 Applications for earth station authorizations.

* * * * *

(d) User transceivers in the NVNG and 1.6/2.4 GHz Mobile-Satellite Service need not be individually licensed. Service vendors may file blanket applications

for transceiver units using FCC Form 493 and specifying the number of units to be covered by the blanket license. Each application for a blanket license under this section shall include the following:

- (1) A general narrative section describing the applicant and the overall system operation,
- (2) A Form 430 (Licensee Qualification Report), if not already on file in conjunction with other facilities licensed under this subpart,
- (3) A Form 493 for each fixed-gateway, TT&C or Network Control Center station operating with the network,
- (4) A Form 493 for each representative type of user transceiver terminal unit,
- (5) A designation of a point of contact where records of individual users will be maintained.

In addition, applicants in the NVNG MSS service shall provide the information described in § 25.135. Applicants in the 1.6/2.4 GHz Mobile-Satellite Service shall demonstrate that the stations comply with the technical requirements specified in § 25.213.

5. Section 25.120 is amended by revising paragraphs (d) and (e) to read as follows:

§ 25.120 License term and renewals.

* * * * *

(d) Space stations.

(1) For geostationary satellite orbit satellites, the license term will begin at 3 a.m. EST on the date the licensee certifies to the Commission that the satellite has been successfully placed into orbit and that the operations of the satellite fully conform to the terms and conditions of the space station radio authorization.

(2) For non-geostationary satellite orbit satellites, the license term will begin at 3 a.m. EST on the date that the licensee certifies to the Commission that its initial space station has been successfully placed into orbit and that the operations of that satellite fully conform to the terms and conditions of the space station system authorization. All space stations launched and brought into service during the ten-year license term shall operate pursuant to the system authorization, and the operating authority for all space stations will terminate upon the expiration of the system license.

(e) **Renewal of licenses.** Applications for renewals of earth station ~~license~~ licenses must be submitted on FCC Form 405 (Application for Renewal of Radio Station License in Specified Services) no earlier than 90 days, and no later than 30 days, before the expiration date of the license. Applications for space station system replacement authorization for non-geostationary orbit satellites shall be filed ~~no earlier than 90 days, and no later than 30 days, prior to the end of the seventh year of~~ at any time during the existing license term.

6. Section 25.130 is amended by revising paragraph (b) to read as follows:

§ 25.130 Filing requirements for transmitting earth stations.

* * * * *

(b) A frequency coordination analysis in accordance with § 25.203 shall be provided for earth stations transmitting in the frequency bands shared with equal rights between terrestrial and space services, except that applications for user transceiver units associated with the NVNG mobile-satellite service shall instead provide the information required by § 25.135 and applications for user transceiver units associated with the 1.6/2.4 GHz Mobile-Satellite Service shall demonstrate that user transceiver operations comply with the requirements set forth in § 25.213.

7. Section 25.133 is amended by revising paragraph (b) to read as follows:

§ 25.133 Period of construction; certification of commencement of operation.

* * * * *

(b) Each license for a transmitting earth station included in this part shall also specify as a condition therein that upon the completion of construction, each licensee must file with the Commission a certification containing the following information: The name of the licensee; file number of the application; call sign of the antenna; date of the license; a certification that the facility as authorized has been completed and that each antenna facility has been tested and is within 2 dB of the pattern specified in § 25.209; the date on which the station became operational; and a statement that the station will remain operational during the license period unless the license is submitted for cancellation. For stations authorized under § 25.115(c) of this part (Large Networks of Small Antennas operating in the 12/14 GHz bands) and § 25.115(d) of this part (User Transceivers in the Mobile-Satellite Service), a

certificate must be filed when the network is put into operation.

8. A new section 25.136 is added to read as follows:

§ 25.136 Operating provisions for earth station networks in the 1.6/2.4 GHz ~~mobile-satellite-service~~ Mobile-Satellite Service

In addition to the technical requirements specified in § 25.213, earth stations operating in the 1.6/2.4 GHz Mobile-Satellite Service are subject to the following operating conditions-:

(a) User transceiver units associated with the 1.6/2.4 GHz ~~mobile-satellite-service~~ Mobile-Satellite Service may not be operated on civil aircraft unless the earth station has a direct physical connection to the aircraft ~~Cabin Communication~~ cockpit and/or cabin communication system.

(b) User transceiver units in this service are authorized to communicate with and through U.S. authorized space stations only. No person shall transmit to a space station unless the specific transmission is first authorized by the space station licensee or by a service vendor authorized by that licensee.

(c) Any user transceiver unit associated with this service will be deemed, when communicating with a particular 1.6/2.4 GHz Mobile-Satellite service system pursuant to paragraph (b) of this section, to be temporarily associated with and licensed to the system operator or service vendor holding the blanket earth station license awarded pursuant to Section 25.115(d). The domestic earth station licensee shall, for this temporary period, assume the same licensee responsibility for the user transceiver as if the user transceiver were regularly licensed to it.

9. Section 25.141 is amended by revising paragraphs (a) and (f) to read as follows:

§ 25.141 Licensing provisions for the ~~radiodetermination satellite-service~~ Radiodetermination Satellite Service.

(a) Space station application requirements. Each application for a space station license in the ~~radiodetermination satellite-service~~ Radiodetermination Satellite Service shall describe in detail the proposed radiodetermination satellite system, setting forth all pertinent technical and operational aspects of the system, including its capability for providing and controlling radiodetermination service on a geographic basis, and the technical, legal and financial qualifications of the applicant. In particular, each application shall include

the information specified in ~~appendix~~ Appendix B of Space Station Application Filing Procedures, 93 FCC 2d 1260, 1265 (1983), except that in lieu of demonstrating compliance with item II.F (two degree spacing), applicants are required to demonstrate compatibility with licensed satellite systems in the same frequency band. Applicants must also file information demonstrating compliance with all requirements of this section, specifically including information demonstrating how the applicant has complied or plans to comply with the requirements of paragraph (f) of this section.

* * * * *

(f) Radiodetermination Satellite Service. Radio-determination ~~satellite service~~. Licensed system licensees shall coordinate with other radiodetermination satellite ~~system licensees~~ systems to avoid harmful interference to ~~other radiodetermination satellite systems~~ through (1) power flux density limits; (2) use of pseudorandom-noise codes (for both the satellite-to-user link and for the user-to-satellite link); and (3) random access, time division multiplex techniques. Licensed Radiodetermination satellite system licensees shall coordinate with 1.6/2.4 GHz Mobile-Satellite Service system licensees to avoid harmful interference to 1.6/2.4 GHz Mobile-Satellite Service systems.

10. A new Section 25.143 is added to read as follows:

§ 25.143 Licensing provisions for the 1.6/2.4 GHz Mobile-Satellite Service.

(a) System License: Applicants authorized to construct and launch a system of ~~technically identical~~ functionally equivalent non-geostationary satellite orbit satellites will be awarded a single "blanket" license covering a specified number of space stations.

(b) Qualification Requirements

(1) General Requirements: Each application for a space station system authorization in the 1.6/2.4 GHz ~~mobile-satellite service~~ Mobile-Satellite Service shall describe in detail the proposed satellite system, setting forth all pertinent technical and operational aspects of the system, and the technical, legal, and financial qualifications of the applicant. In particular, each application shall include the information specified in § 25.114.

(2) Technical Qualifications: In addition to providing the information specified in (b)(1), each applicant shall demonstrate the following:

(i) that the proposed system employs a non-geostationary constellation or constellations of satellites;

(ii) that the proposed system is capable of providing ~~mobile satellite services~~ Mobile Satellite Services to all areas of the world, with the exception of the polar regions (above 80° latitude), at least 75% of every 24-hour period, i.e., that at least one satellite will be visible above the horizon at an elevation angle of at least 5° from any point in the world other than the polar regions for at least 18 hours each day, a day at the design elevation angle required for the system to provide Mobile Satellite Services to that point, provided that this angle must be at least 5°;

(iii) that each applicant certifies that it shall establish, or arrange for the establishment of, the ground segment infrastructure necessary to permit provision of Mobile Satellite Service in countries representing at least 75% of the surface area and population of the world within six years of the grant of its space station license;

(iv) that the proposed system is capable of providing ~~voice service~~ Mobile Satellite Service on a continuous basis throughout the fifty states of the U.S., and all U.S. territories and possessions including Guam, American Samoa, the Commonwealth of Puerto Rico and the U.S. Virgin Islands, i.e., that at least one satellite will be visible above the horizon at an elevation angle of at least 5° at any point within the United States at all times from any point in the foregoing territory for 24 hours a day at the design elevation angle required for the system to provide Mobile Satellite Service to that point, provided that this angle is at least 5°;

~~(iv)~~ (v) that operations will not cause unacceptable harmful interference to other authorized users of the spectrum. In particular, each application shall demonstrate that the space station(s) comply with the requirements specified in § 25.213.

(vi) For the purpose of demonstrating that it is qualified under this paragraph, each applicant shall certify in its application the minimum elevation angle at which its system can provide Mobile Satellite Service, and shall submit

satisfactory technical documentation to support this certification.

(3) Financial Qualifications: Each applicant for a space station system authorization in the 1.6/2.4 GHz ~~mobile-satellite service~~ **Mobile-Satellite Service** must demonstrate, on the basis of the documentation contained in its application, that it is financially qualified to meet the estimated costs of the construction and launch of all proposed space stations in the system and the estimated operating expenses for one year after the launch of the ~~initial space station~~ **entire constellation as set forth in its application.** Financial qualifications must be demonstrated in the form specified in §§ 25.140(c) and (d). ~~Failure to make such a showing will result in the dismissal of the application.~~

(4) Failure to make any of the showings required in this part of the rules will result in the dismissal of the application.

(c) Replacement of Space Stations Within the System License Term. Licensees of non-geostationary 1.6/2.4 GHz mobile-satellite systems authorized through a blanket license pursuant to paragraph (a) of this section need not file separate applications to construct, launch and operate ~~technically identical~~ **functionally equivalent** replacement satellites within the term of the system authorization. However, the licensee shall certify to the Commission, at least thirty days prior to launch of such replacement(s) that:

(1) the licensee intends to launch a space station that is ~~technically identical~~ **functionally equivalent** to those authorized in its system authorization, and

(2) launch of this space station will not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

(d) In-Orbit Spares. Licensees need not file separate applications to operate ~~technically identical~~ **functionally equivalent** in-orbit spares authorized as part of the blanket license pursuant to paragraph (a) of this section. However, the licensee shall certify to the Commission, within 10 days of bringing the in-orbit spare into operation, that operation of this space station did not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

(e) Reporting requirements.

(1) All ~~operators~~ licensees of 1.6/2.4 GHz mobile-satellite systems shall, on June 30 of each year, file with the Common Carrier Bureau and the Field Office in Laurel, Maryland a report containing the following information:

(i) Status of satellite construction and anticipated launch dates, including any major problems or delays encountered;

(ii) A listing of any non-scheduled space station outages for more than ~~30 minutes~~ 2 hours and the cause or causes of the outage, if known;

~~(iii) A detailed description of the utilization made of the in-orbit satellite system. That description should identify the percentage of time that the system is actually used for U.S. domestic or transborder transmission, the amount of capacity (if any) sold but not in service within U.S. geographic areas, and the amount of unused system capacity; and~~

~~(iv)~~ (iii) Identification of any space stations not available for service or otherwise not performing to specifications, the cause or causes of these difficulties, and the date any space station was taken out of service or the malfunction identified.

(2) All ~~operators~~ licensees of 1.6/2.4 GHz mobile-satellite system shall, within 10 days after a required implementation milestone as specified in the system authorization, certify to the Commission by affidavit that the milestone has been met or notify the Commission by letter that it has not been met. At its discretion, the Commission may require the submission of additional information (supported by affidavit of a person or persons with knowledge thereof) to demonstrate that the milestone has been met.

(f) Safety and distress communications. Stations operating in the 1.6/2.4 GHz Mobile-Satellite Service that are used to comply with any statutory or regulatory equipment carriage requirements may also be subject to the provisions of Sections 321(b) and 359 of the Communications Act of 1934, as amended. Licensees are advised that these provisions give priority to radio communications or signals relating to ships in distress and prohibits a charge for the transmission of maritime distress calls and related traffic.

(g) Considerations involving transfer or assignment applications.

(1) "Trafficking" in licenses issued pursuant to paragraph (a) of this section is prohibited.

(2) The Commission will review a proposed transaction to determine if the circumstances indicate trafficking in licenses whenever applications (except those involving pro forma assignment or transfer of control) for consent to assignment or a license, or for transfer of control of a licensee, involve facilities licensed pursuant to paragraph (a) of this section. At its discretion, the Commission may require the submission of an affirmative, factual showing (supported by affidavits of a person or persons with personal knowledge thereof) to demonstrate that no trafficking has occurred.

(3) If a proposed transfer of radio facilities is incidental to a sale of other facilities or merger of interests, any showing requested under paragraph (g)(2) of this section shall include an additional exhibit which:

(i) Discloses complete details as to the sale of facilities or merger of interests;

(ii) Segregates clearly by an itemized accounting, the amount of consideration involved in the sale of facilities or merger of interests; and

(iii) Demonstrates that the amount of consideration assignable to the facilities or business interests involved represents their fair market value at the time of the transaction.

11. Section 25.201 is amended by adding new paragraphs, in alphabetical order, to read as follows:

§ 25.201 Definitions.

Aeronautical Mobile-Satellite Service: A mobile-satellite service in which mobile earth stations are located on board aircraft; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service.

Aeronautical Mobile-Satellite (R) Service: An aeronautical mobile-satellite service reserved for communications relating to safety and regularity of flights, primarily along national or international civil air routes.

* * * * *

Mobile-Satellite Service. A radiocommunication service:

- (1) Between mobile earth stations and one or more space stations, or between space stations used by this service; or
- (2) Between mobile earth stations by means of one or more

space stations. This service may also include feeder links necessary for its operation. [RR]

* * * * *

1.6/2.4 GHz Mobile-Satellite Service. A mobile-satellite service that operates in the 1610-1626.5 MHz and 2483.5-2500 MHz frequency bands, or in any portion thereof.

* * * * *

12. Section 25.202 is amended by adding new paragraphs (a)(4), (a)(5) and (a)(6), revising paragraph (f) and adding new paragraphs (g) and (h) to read as follows:

§ 25.202. Frequencies, frequency tolerance and emission limitations.

* * * * *

(a) * * *

(4) The following frequencies are available for use by the 1.6/2.4 GHz Mobile-Satellite Service:

1610-1626.5 MHz	User-to-Satellite Link
1613.8-1626.5 MHz:	Satellite-to-User Link (secondary)
2483.5-2500 MHz:	Satellite-to-User Link

(5) The following frequencies are available for use by the intersatellite service:

22.55-23.00	GHz
23.00-23.55	GHz
24.45-24.65	GHz
24.65-24.75	GHz

(6) The following frequencies are available for use by the Aeronautical Mobile Satellite (R) Service:

1610.00-1626.5 MHz (Earth-to-Space)
1610.00-1626.5 MHz (Space-to-Earth)

* * * * *

(f) Emission limitations. Except as specified in subsections (g) and (h), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule.

* * * * *

(q) Emission limitations in the 1610-1626.5 MHz band. Earth stations with a maximum antenna gain of 0 dBi at 0° local elevation and 3 dBi at other elevation angles when the transmitter is operated in its normal configuration and attitude. The mean power of emissions shall not exceed the power spectral density limits specified for each area of frequency separations from the band edge or the boundary between the segments of the 1610-1626.5 MHz band assigned respectively to Code Division Multiple Access and Frequency Division Multiple Access/Time Division Multiple Access modulations, as follows:

<u>Frequency Separation</u>	<u>Power Spectral Density</u>
<u>$\Delta f < 125 \text{ kHz}$</u>	<u>-45 dBW/3 kHz</u>
<u>$125 \text{ kHz} \leq \Delta f < 1.25 \text{ MHz}$</u>	<u>-60 dBW/3 kHz</u>
<u>$\Delta f \geq 1.25 \text{ MHz}$</u>	<u>-70 dBW/3 kHz</u>

Where Δf is the frequency separation from the edge of the authorized band segment.

(h) Emission limitations in the 1610-1626.5 MHz band, Earth stations with maximum antenna gain exceeding the limits specified in subsection (q). The mean power of emissions shall not exceed the power spectral density limits specified for each area of frequency separations from the band edge or the boundary between the segments of the 1610-1626.5 MHz band assigned respectively to Code Division Multiple Access and Frequency Division Multiple Access/Time Division Multiple Access modulations, as follows:

<u>Frequency Separation</u>	<u>Power Spectral Density</u>
<u>$\Delta f < 125 \text{ kHz}$</u>	<u>-45 dBW/3 kHz - [10log(G) - 3 dB]</u>
<u>$125 \text{ kHz} \leq \Delta f < 1.25 \text{ MHz}$</u>	<u>-60 dBW/3 kHz - [10log(G) - 3 dB]</u>
<u>$\Delta f \geq 1.25 \text{ MHz}$</u>	<u>-70 dBW/3 kHz - [10log(G) - 3 dB]</u>

Where Δf is the frequency separation from the edge of the authorized band segment, and G is the maximum antenna gain at any elevation angle in dBi.

13. Section 25.203 is amended by revising subsections (b) and (c)(2)(vii), redesignating subsections (c) through (i) as (d) through (j), and adding new subsections (k) and (l) to read as follows:

§ 25.203 Choice of sites and frequencies. (e) * * *

13. Section 25.203 is amended by revising paragraph (e)(2)(vii) and adding new subsection (j) and (k) to read as follows:

~~§ 25.203 Choice of sites and frequencies.~~

~~* 1 (2)(vii) Antenna horizon gain plot(s) determined in accordance with § 25.253(b) for satellite longitude range specified in paragraph (C)(2)(v) of this section, taking into account the provisions of § 25.253(a)(2) for earth stations operating with non-geostationary satellites.~~

~~* * * * *~~

~~(j) Applicants for non-geostationary 1.6/2.4 GHz Mobile-Satellite Service / radiodetermination satellite service feeder links outside the bands specified in § 25.202(a)(5) shall indicate the frequencies and spacecraft antenna gain contours towards each feeder-link earth station location and will coordinate with licensees of other fixed-satellite service and terrestrial service systems sharing the band to determine geographic protection areas around each non-geostationary mobile-satellite service / radiodetermination satellite service feeder link~~

(b) An applicant for an earth station authorization in association with a geostationary space station in a frequency band shared with equal rights with terrestrial microwave services shall compute the great circle coordination distance contour(s) for the proposed station in accordance with the procedures set forth in §§ 25.251 through 25.253 and the rain scatter coordination distance contour(s) for the proposed station in accordance with the procedures set forth in § 25.254. The applicant shall submit with his application a map or maps drawn to appropriate scale and in a form suitable for reproduction indicating the location of the proposed station and these contours. These maps, together with the pertinent data on which the computation of these contours is based, including all relevant transmitting and/or receiving parameters of the proposed station that might be useful in assessing the likelihood of interference, an appropriately scaled plot of the elevation of the local horizon as a function of azimuth, and the electrical characteristics of the earth station antenna(s), shall be submitted by the applicant in a single exhibit to his application. At a minimum, this exhibit (labeled "Exhibit 2"), shall include the information listed in paragraph (d)(2) of this section. An earth station applicant shall also include in his application relevant technical details (both theoretical calculations and/or actual measurements) of any special techniques, such as the use of artificial site shielding, or operating procedures or restrictions at the proposed earth station which to be employed to reduce the likelihood of interference, or of any particular characteristics of the earth station site, such as horizon obstacles closer than 1 kilometer, which could have an effect on the calculation of the coordination distance.

(c) An applicant for an earth station authorization in association with a non-geostationary space station in a frequency band shared with equal rights with terrestrial microwave services shall compute the coordination contours in accordance with the method prescribed in Recommendation 849 as set forth in the ITU 1992 CCIR Recommendations RIS Series Inter-Service Sharing and Compatibility.

(d) Prior to the filing of his application, an earth station applicant (both non-GSO and GSO) shall coordinate the proposed frequency usage with existing terrestrial users and with applicants for terrestrial station authorizations with previously filed applications in accordance with the following procedure:

(1) An applicant for an earth station authorization shall perform an interference analysis in accordance with the procedures set forth in § 25.255 (where the earth station(s) would operate in association with a geostationary space station) or ITU-R Recommendation 849 (where the earth station(s) would operate in association with a non-geostationary space station) as appropriate for each terrestrial station, for which a license or construction permit has been granted or for which an application has been accepted for filing, which is or is to be operated in a shared frequency band to be used by the proposed earth station and which is located within the great circle coordination distance contour(s) of the proposed earth station.

(2) The earth station applicant shall provide each such terrestrial station licensee, permittee, and prior filed applicant with the technical details of the proposed earth station and the relevant interference analyses that were made. At a minimum, the earth station applicant shall provide the terrestrial user with the following technical information:

(i) The geographical coordinates of the proposed earth station antenna(s),

(ii) Proposed operating frequency band(s) and emission(s),

(iii) Antenna center height above ground and ground elevation above mean sea level,

(iv) Antenna gain pattern(s) in the plane of the main beam,

(v) Longitude range of geostationary satellites at which antenna may be pointed,

(vi) Horizon elevation plot,

(2)(vii) Antenna horizon gain plot(s) determined in accordance with § 25.253(b) or ITU-R Recommendation 849 as appropriate for satellite longitude range specified in paragraph (c)(2)(v) (d)(2)(v) of this section, taking into account the provisions of § 25.253(a)(2) for earth stations operating with non-geostationary satellites.

(viii) Minimum elevation angle,

(ix) Maximum effective isotropically radiated power (EIRP) in any 4 kHz band in the main beam (dBW/4 kHz),

(x) Maximum available RF transmit power in any 1 MHz band and in any 4 kHz band at the input terminals of the antenna(s),

(xi) Maximum permissible RF interference power level as determined in accordance with § 25.252 or ITU-R Recommendation 849 as appropriate for all applicable percentages of time, and

(xii) A plot of great circle coordination distance contour(s) and rain scatter coordination distance contour(s) as determined by §§ 25.253 and 25.254 or ITU-R Recommendation 849 as appropriate.

(3) The coordination procedure specified in § 21.100(d) of this chapter shall be applicable except that the information to be provided shall be that set forth in paragraph (d)(2) of this section, and that the 30-day period allowed for response to a request for coordination may be increased to a maximum of 45 days by mutual consent of the parties.

(4) Where technical problems are resolved by an agreement or operating arrangement between the parties that would require special procedures be taken to reduce the likelihood of harmful interference (such as the use of artificial site shielding) or would result in lessened quality or capacity of either system, the details thereof shall be contained in the application.

(5) In those instances where the calculations of expected interference indicate a margin of less than 5 dB, the applicant shall submit with the application to the Commission, certain additional information: The gains assumed for both the terrestrial and earth station antennas in the direction of the other station; the calculated transmission loss; and the resulting margin above the controlling objective. The Commission may, in the course of examining any application, require the submission of additional showings, complete with pertinent data and

calculations in accordance with §§ 25.251 through 25.256, showing that harmful interference will not likely result from the proposed operation.

* * * * *

(k) Applicants for non-geostationary 1.6/2.4 GHz Mobile-Satellite Service and Radiodetermination Satellite Service feeder links within the bands specified in § 25.202(a)(1) shall indicate the frequencies and spacecraft antenna gain contours towards each feeder-link earth station location and will coordinate with licensees of other Fixed-Satellite Service and terrestrial-service systems sharing the band.

~~(k)(1)~~ An applicant for a ~~non-geostationary space station~~ or an earth station that will operate with a geostationary satellite or non-geostationary satellite in a shared frequency band in which the non-geostationary system is (or is proposed to be) licensed for feeder links, shall demonstrate in its application that its proposed ~~space~~ or earth station will not cause unacceptable interference to any other satellite network that is authorized to operate in the same frequency band, or certify that the operations of its ~~space~~ or earth station shall conform to established coordination agreements between the operator(s) of the space station(s) with which the earth station is to communicate and the operator(s) of any other space station licensed to use the band.

14. Section 25.208 is amended by revising paragraph (c) to read as follows:

§ 25.208 Power flux density limits.

(c) In the 17.7-19.7 GHz, 22.55-23.00 GHz, 23.00-23.55 GHz, and 24.45-24.75 GHz frequency bands, the power flux density at the Earth's surface produced by emissions from a space station for all conditions and for all methods of modulation shall not exceed the following values:

-115 dB (W/m²) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane.

-115 + 0.5 (d-5) dB (W/m²) in any 1 MHz band for angles of arrival d (in degrees) between 5 and 25 degrees above the horizontal plane.

-105 dB (W/m²) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

These limits relate to the power flux density which would be obtained under assumed free-space propagation conditions.